REMARKS

The present Response is intended to be fully responsive to all points of rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application are respectfully requested.

Status of Claims

Claims 11-20 are pending in the application.

CLAIM REJECTIONS

35 U.S.C. § 102 Rejections

Claims 11-14, and 16-19 have been rejected under 35 USC §102(e) as being anticipated by Guehring et al. (US Patent No. 6,213,692). Specifically, the Examiner contends that Guehring teaches a rotary multi-tooth milling cutter (1, see Fig. 1, note milling cutter is intended used as indicated in Col. 1, lines 3-5) with at least one tooth including a lateral cutting edge (22), which rotates about a central cutter axis (27) and cuts generally parallel thereto, the tooth further including a tooth face (8 or 9, Fig. 2) between the cutting edge (22) and the central cutter axis (27), the tooth face comprising: at least two sections between the cutting edge and central cutter axis, a first section (curved convex ridge near 22) nearest the cutting edge (22) having a convex form, and a second section (groove 18 portion) being concave.

Applicant respectfully traverses the rejection of claims 11-14 and 16-19 under 35 U.S.C. § 102(e), inter alia, because a prima facie case of anticipation has not been established, as discussed below.

As is well established, in order to successfully assert a prima facie case of anticipation, the Examiner must provide a single prior art document that teaches every element and limitation of the clam or claims being rejected.

Each of independent claims 11 and 16 recites a milling cutter having a lateral cutting edge, which rotates about a central cutter axis and cuts generally parallel thereto. It is respectfully asserted that Guehring et al. does not teach or fairly suggest at least this feature of the claimed invention, as discussed below.

Guehring et al. describes a cutting tool including a slide layer having a lower hardness than a base layer of the cutting member (Abstract lines 4-6; and Col. 1, line 66 – Col. 2, line 20). As noted by the Examiner, the Guehring et al. reference categorizes itself as relating to "a cutting tool such as a drill, milling cutter, screw tap, reamer or core drill in accordance with the preamble of claim 1" (Col. 1 lines 3-5). It is respectfully asserted that none of these tools includes a lateral cutting edge, which rotates about a central cutter axis and cuts generally parallel thereto, as recited by independent claims 11 and 16. Additionally, the cutting tools of Guehring et al. on which the Examiner bases the rejection of claims 11-14 and 16-19, e.g., as shown in 1-3 and described in corresponding parts of the specification of Guehring et al., all relate to a drill, which inherently does <u>not</u> include a lateral cutting edge to rotate about a central cutter axis and cut generally parallel thereto, as discussed in detail below.

Applicant respectfully disagrees with the Examiner's statement that element 22 in Fig. 2 of Guehring et al. refers to "a lateral cutting edge, which rotates about a central cutter axis and cuts generally parallel thereto". As discussed in detail below, Applicant respectfully submits that element 22 does not refer to a cutting edge of a milling cutter; in fact, element 22 of Guehring is a margin portion of a drill, which is fundamentally different, both structurally and functionally, from a cutting edge of a milling cutter, as is known in the art.

Milling Cutters are clearly defined in the art as rotating cylindrical tools with many cutting edges (See, e.g., *"Machine Tool Operation – part one", Henry D. Burghardt et al., McGraw Hill book company, fifth edition, 1959, ("Burghardt"), p. 26,* attached hereto as Appendix A). A milling cutter may have teeth either only on its circumferential surface (plain milling cutter) or on both the circumferential surface and one end of the cutter (end mill). The teeth may be either parallel to the axis of rotation, or helical (See, e.g., *"Kent's Mechanical Engineers' Handbook", Colin Carmichael, Twelfth Edition, 1955, pp. 23-48 and 23-49,*

attached hereto as Appendix B). Each of the teeth of the milling cutter may have a cutting edge.

A drill is clearly defined in the art as a cutting tool used for producing a circular hole by removing solid metal. The cutting edges of the drill are defined at the point of the drill, and the flute of the drill is a groove which carries out chips and admits a coolant (See, e.g., Burghardt, pp. 180-181, attached hereto as Appendix C). During operation, a drill is advanced in a direction parallel to the rotation axis of the drill, such that the cutting edge at the point of the drill cuts generally perpendicular to the rotation axis.

A margin of a drill includes "the narrow surface along the groove that determines the size of the drill and keeps the drill aligned" (See, e.g., Burghardt, p. 181, and corresponding Fig. on p. 180). The margin of a drill is also defined and illustrated in *"Machinery's Handbook", Erik Oberg et al, Industrial Press Inc., twenty-fifth edition, 1996, pp. 825-826 ("Oberg"),* attached hereto as Appendix D, as "the cylindrical portion of the land which is not cut away to provide clearance".

Fig. 2 of Guehring et al. is described as being a "top view on a bit of a drilling tool" (Col. 3, lines 6-7). Accordingly, although element 22 as shown in Fig. 2 is referred to by Guehring et al. as a "minor cutting edge", it is clearly evident from the above commonly accepted descriptions and figures of Burghardt and Oberg, that element 22 of Guehring must refer to the <u>margin</u> of the drill and <u>not</u> to a <u>cutting edge</u> of the drill. A cutting edge of the Guehring drill may be the portion at the point of the drill (e.g., 8 and 9 in Fig. 2). Thus, element 22 as shown in Fig. 2 of Guehring et el. is clearly <u>not</u> "a lateral cutting edge, which rotates about a central cutter axis and cuts generally parallel thereto", as recited by independent claims 11 and 16.

Guehring et al. therefore fails to teach all elements of claims 11 and 16, at least because this reference does not teach "a rotary multi-tooth milling cutter with at least one tooth including a lateral cutting edge which rotates about a central cutter axis and cuts generally parallel thereto". Thus, the Office Action has therefore failed to establish a prima facie showing of anticipation of claim 11 and 16 and Applicant respectfully requests that this rejection be withdrawn.

Furthermore, it is respectfully asserted that the distinguishing features of independent claims 11 and 16, as discussed above, would not have been obvious at the time the invention was made to a person skilled in the art, in view of Guehring, alone of in combination with any other cited references, including the Noda reference discussed below in connection with claims 15 and 20. Therefore, it is respectfully asserted that independent claims 11 and 16 are patentable, and thus allowable, over the prior art references on record.

Claims 12-14 depend directly from independent claim 11 and incorporate all the elements of this claim. Claims 17-19 depend directly from independent claim 16 and incorporate all the elements of this claim. Therefore, it is respectfully submitted that claims 12-14 and 17-19 are patentable, and thus allowable, at least for the reasons set forth above.

In view of the above, Applicant respectfully requests that the Examiner withdraw the rejection of claims 11-14 and 16-19.

35 U.S.C. § 103 Rejections

Claims 15 and 20 were rejected under 35 U.S.C. 103§(a) as being unpatentable over Guehring et al. in view of Noda et al. (U.S. Patent No. 5454670).

Claim 15 depends directly from independent claim 11 and incorporates all the elements of this claim. Claim 20 depends directly from independent claim 16 and incorporates all the elements of this claim. Therefore, it is respectfully submitted that claims 15 and 20 are patentable at least for the reasons set forth above. Furthermore, it is respectfully submitted that Noda et al. has not been cited as curing, and in fact does not cure, the above discussed deficiencies of Guehring et al. Specifically, Noda et al., like Guehring, fails to teach a rotary multi-tooth milling cutter with at least one tooth including a lateral cutting edge which rotates about a central cutter axis and cuts generally parallel thereto, the tooth face comprising at least two sections between the cutting edge and central cutter axis, a first section nearest the cutting edge being convex and the second section being concave.

Accordingly, Applicant respectfully requests that the Examiner withdraw the rejection of dependent claims 15 and 20.

Conclusion

In view of the foregoing amendments and remarks, the pending claims are deemed to be allowable. Their favorable reconsideration and allowance is respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 05-0649.

Respectfully submitted,

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Dated: November 21, 2004

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Milling. Milling consists of machining a piece of metal by bringing it into contact with a rotating cutter with many cutting edges. This process includes the hobbing of gears. Machine tools that perform a milling operation include horizontal milling machines, universal milling machines, vertical milling machines, planer-type milling machines, gear hobbing, profilers, and routers. Circular saws, although usually classed as cut-off machines, also do a milling job.

Fig. 2-1. The well-dressed operator—sleeves rolled up and wearing goggles—standing safely on the "going-away" side of the cutter.

The chief hazard of machine tools that perform a milling function is accidental contact with the revolving cutter. Such accidental contact may occur in removing chips, particularly if a rag instead of a brush is used. Loose clothing creates a serious hazard around a rotating cutter; the loose sleeve, necktie, or apron becomes wound around the cutter and draws the operator into contact with the cutting edges. Flying chips also create an eye hazard.

Figure 2-1 shows how a safe machine operator should be dressed when operating a machine. He has his sleeves rolled up, wears goggles, and is standing on the "going-away" side of the cutter. Figure 2-2 is another example of good and safe dress for an operator

In *up-milling* the portion of the finished surface produced by a tooth is formed at the beginning of its contact with the work piece, when the chip thickness is extremely small. Hence, the built-up edge itself is very small, and the resultant surface is smooth and shiny. In *down-milling* an element of the finished surface is produced at the end of the tooth engagement with the work. With a ductile material such as a low-carbon steel, where the built-up edge is large, the built-up edge persists to the extreme end of the chip; thus fragments continue to escape, producing a somewhat torn finish similar to that obtained by planing or shaping. With a less ductile material, such as a high-carbon steel, the built-up edge is smaller; hence, the difference in finish between up-and-down methods of milling is less marked. (See Ref. 2.)

20. MILLING CUTTERS

Cutting materials generally used for milling cutters are of these types: (1) (*a*) carbon tool steel and (*b*) alloy tool steel (high-speed steel); (2) cast nonferrous alloys; and (3) sintered carbides.

CARBON AND HIGH-SPEED STEEL-CUTTING MATERIALS. Carbon tool steel and high-speed steel milling cutters are generally made in accordance with the standards approved by the American Standards Association. See Ref. 3 for discussions of the most commonly used types.

The classifications adopted are listed below. Although carbon tool steel is still used to some extent for screw slotting and slitting cutters, and other light-duty work, practically all heavy-duty milling cutters of these types are made of high-speed steel.

For most classes of work, high-speed steel cutters can be run 2 to 2 1/2 times as fast as carbon steel cutters.

A. CLASSIFICATION BASED ON RELIEF OF TEETH. 1. Profile cutters include all forms of cutters which are sharpened by grinding on the periphery of the teeth, the clearance angle (or relief) being obtained by grinding a narrow land back of the cutting edge. Where the cutting edges are of curved or irregular shape, they are designated *shaped profile cutters*.

2. Formed cutters include all cutters where the eccentric relief back of the cutting edge is of the same contour as the cutting edge itself. These cutters are sharpened by grinding the face of the teeth.

B. CLASSIFICATION BASED ON METHOD OF MOUNTING. 1. **Arbor Cutters.** A cutter with hole for mounting on arbor.

2. **Shank Cutters.** All cutters having either a straight or taper shank integral with the cutter.

3. **Face Milling Cutters.** All cutters designed to be attached directly to the spindle nose, or to the end of a short arbor known as a stub arbor.

C. CLASSIFICATION BASED ON TYPE AND USES. The commonly used types of cutters and the work to which they are adapted are discussed below.

The plain milling cutter (Fig. 4) is a cylinder with teeth on the circumferential surface only. It is used to produce a flat surface parallel to the axis of the cutter. Plain milling cutters are made in a wide variety of diameters and widths, for the various requirements of slab milling. They generally have helical teeth. The helical form enables each tooth to take a cut gradually, thus reducing shock and minimizing tendency to chatter. Cutters with a helix angle of 25 to 45 degrees, commonly, but incorrectly, are termed *spiral mills*; if helix angle is more than 45 degrees the cutter generally is known as a *helical mill*.

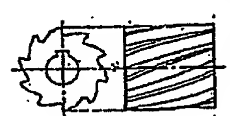


FIG. 4. Plain milling cutter.

The helical mill, which may be either of the shank or hole type, is free cutting and particularly desirable for light cuts on soft steel or brass. It can be used to advantage for profiling work, such as cam milling, and for milling intermittent surfaces. The shank type, with pilot end, commonly is used for elongating slots. For general slab milling, the helical mill is not as efficient as the common "spiral" mill.

The side milling cutter is a plain milling cutter of cylindrical form with teeth on the circumferential surface and on both sides. The side teeth extend a portion of the distance from the circumference to the axis. Half side and interlocking side milling cutters also are made. Side milling cutters are used in a large variety of work. Two or more of them often are placed on the same arbor with a space between them; they are then known as straddle mills.

Straddle mills are used to advantage where the work is to be milled on two parallel sides, e.g., bolt heads and tongues.

Interlocking cutters are used to mill slots to a standard width. They are maintained at a constant width by thin shims or collars between the inner hubs.

Staggered tooth milling cutters (Fig. 5) are cylindrical cutters with the cutting teeth on the circumferential surface only. Alternate teeth are of opposite helix angle. (See Fig. 5.) The side teeth extending from the circumference a short distance towards the axis are for chip clearance only. They are not ground for cutting purposes. This type of cutter, used to obtain exact width of slots, is the most efficient type for milling slots where depth exceeds width. Because of the alternate right- and left-hand helix angle of the teeth, with

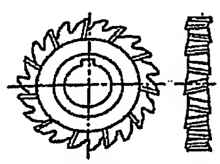


Fig. 5. Staggered tooth cutter.

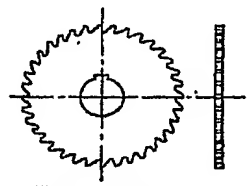


Fig. 6. Slitting saw.

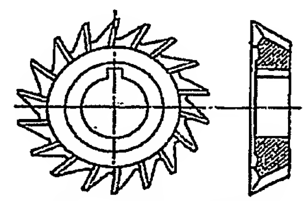


Fig. 7. Single-angle cutter.

considerable undercut, these cutters can remove large amounts of metal without vibration or chatter. The free-cutting action makes possible an increased feed and speed, without detriment to the production of smooth, accurate work.

Metal slitting saws (Fig. 6) are plain milling cutters with sides relieved or "dished" to give side clearance. They generally are made $^3/_{16}$ in. thick or less, and usually have more teeth for a given diameter than a plain milling cutter. They are used to cut off work, or to mill very narrow slots. Slitting saws also are made with side teeth similar to side milling cutters, and with staggered teeth, similar to staggered tooth milling cutters. The metal slitting saw with staggered teeth usually is made $^3/_8$ to $^3/_{16}$ in. thick, and is used for heavy sawing in steel.

Angle milling cutters are made both single angle and double angle, with teeth on the conical surfaces. (See Figs. 7 and 8.) Single-angle cutters are made both with and without teeth on one or both of the flat sides. Angle cutters are used for various fluting operations, or for milling the edge of a piece to a given angle.

Formed cutters usually have a curved tooth outline and are used in milling contours of various shapes. They may be divided into two classes: (a) the shaped or formed profile cutters and (b) the form or cam relieved cutters. They can also be classified as profile-ground and face-ground formed cutters, respectively, according to the method of sharpening.

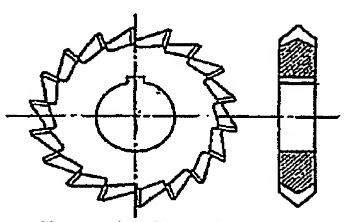


Fig. 8. Double-angle cutter.

(a) *Shaped or formed profile cutters* are sharpened by grinding a small land back of the cutting edge, as in the case of plain milling cutters, and the contour of the cutter must be reproduced every time the cutter is resharpened.

(b) *Formed or cam relieved cutters* are so termed in contradistinction to shaped profile cutters because the clearance back of the cutting edge is produced by a form or master tool in a cam relieving machine, giving all the teeth the contour of the master tool. They are sharpened by grinding the face of the teeth.

So long as the face of a tooth is maintained in its original plane with respect to the axis of rotation, the contour of the tooth will remain unchanged.

This type of cutter includes gear cutters, multiple-gear cutters, sprocket cutters, convex cutters, concave cutters, corner rounding cutters, spline cutters, etc.

Formed and shaped cutters are used for the accurate duplication of varying outlines or shapes and make possible economical milling of complicated contours.

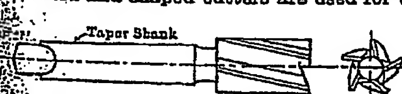


Fig. 9. End mill.

End mills (Fig. 9) are cutters with teeth on the circumferential surface and on one end. The teeth may be either parallel to the axis of rotation or helical, and either right or left hand. End mills of moderate angle commonly are called spiral end mills. End mills are made of five general types: solid end mill; two-lip end mill or slotting mill; shell end mill; hollow mill; helical end mill.

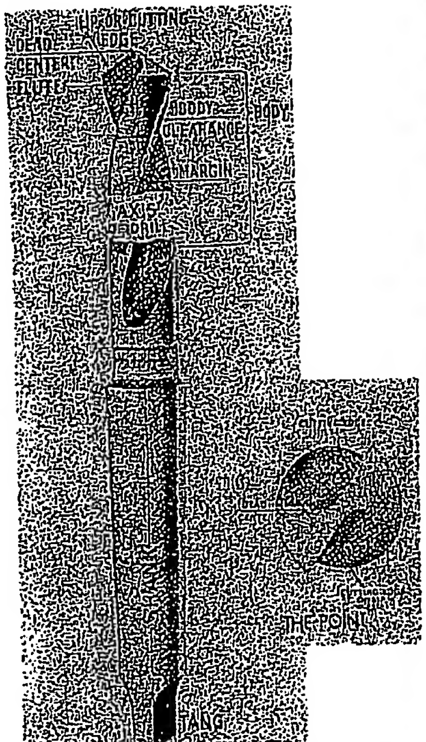


Fig. 8-12. Parts of a twist drill. (*The Cleveland Twist Drill Company*)

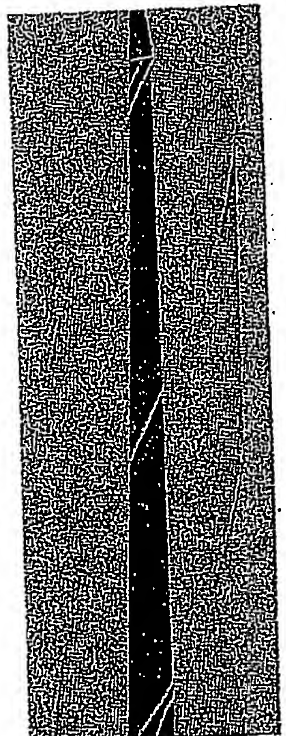


Fig. 8-13. The web of a drill. (*The Cleveland Twist Drill Company*)

DEFINITIONS: DRILL PARTS AND FUNCTIONS

Point. The point is the conical part of the drill. On the point, the cutting lips are ground.

Body. The body is the part of the drill that is fluted and relieved.

Shank. The shank is the part that fits into the holding device.

Flute. The flute is the groove of the drill. It carries out the chips and admits the coolant.

Tang. The tang is the flattened end of the taper shank. It helps drive the drill and provides means for driving the drill from the socket without injuring the shank.

Dead Center. Dead center is the point at which the two lips, properly ground, meet.

Lips. The lips of a drill are its cutting edges.

Margin. The margin is the narrow surface along the groove that determines the size of the drill and keeps the drill aligned.

Web. The web is the narrow section between the flutes. It is the "backbone" on the drill (Fig. 8-13).

Twist drills are made in *number* sizes; No. 1 (0.228 in. diameter) to No. 80 (0.0135 in. diameter). They are also made in *letter* sizes; A (0.234 in. diameter) to Z (0.413 in. diameter). See Table 18, page 542, for all sizes of number and letter drills. They are also made in sizes ranging from $\frac{1}{64}$ in., in sixty-fourths of an inch to 4 in. or larger, and in metric sizes as well. The smaller sizes of drills are not usually marked and the size is found by the use of a *drill gage* (Fig. 8-14).

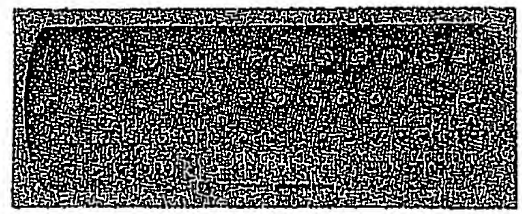


Fig. 8-14. A twist drill and steel wire gage. (*The Brown & Sharpe Manufacturing Company*)

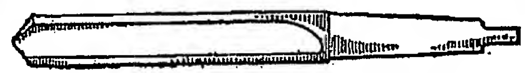


Fig. 8-15. Taper-shank straight-fluted drill.

The Straight-fluted Drill. For drilling brass, copper, and other soft metals, a drill with rake (a twist drill) has a tendency to "dig," or "grab." A straight-fluted Farmer drill (Fig. 8-15) is the best to use for soft metals, but a twist drill may be used if the fronts of the lips are ground as shown in Fig. 8-16. It is also advisable to use a drill without rake when drilling very thin stock because of the tendency of the drill to "hook" into the work when it is breaking through.

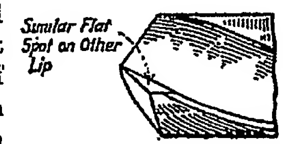


Fig. 8-16. Twist drill ground for use on brass.

TWIST DRILLS AND COUNTERBORES

Twist drills are rotary end-cutting tools having one or more cutting lips and one or more straight or helical flutes for the passage of chips and cutting fluids. Twist drills are made with straight or tapered shanks, but most have straight shanks. All but the smaller sizes are ground with "back taper," reducing the diameter from the point toward the shank, to prevent binding in the hole when the drill is worn.

Straight Shank Drills: Straight shank drills have cylindrical shanks which may be of the same or of a different diameter than the body diameter of the drill and may be made with or without driving flats, tang, or grooves.

Taper Shank Drills: Taper shank drills are preferable to the straight shank type for drilling medium and large size holes. The taper on the shank conforms to one of the tapers in the American Standard (Morse) Series.

American National Standard. — American National Standard B94.11M-1979 (R1987) covers nomenclature, definitions, sizes and tolerances for High Speed Steel Straight and Taper Shank Drills and Combined Drills and Countersinks, Plain and Bell types. It covers both inch and metric sizes. Dimensional tables from the Standard will be found on the following pages.

Definitions of Twist Drill Terms. — The following definitions are included in the Standard.

Axis: The imaginary straight line which forms the longitudinal center of the drill.

Back Taper: A slight decrease in diameter from point to back in the body of the drill.

Body: The portion of the drill extending from the shank or neck to the outer corners of the cutting lips.

Body Diameter Clearance: That portion of the land that has been cut away so it will not rub against the wall of the hole.

Chisel Edge: The edge at the ends of the web that connects the cutting lips.

Chisel Edge Angle: The angle included between the chisel edge and the cutting lip as viewed from the end of the drill.

Clearance Diameter: The diameter over the cutaway portion of the drill lands.

Drill Diameter: The diameter over the margins of the drill measured at the point.

Flutes: Helical or straight grooves cut or formed in the body of the drill to provide cutting lips, to permit removal of chips, and to allow cutting fluid to reach the cutting lips.

Helix Angle: The angle made by the leading edge of the land with a plane containing the axis of the drill.

Land: The peripheral portion of the drill body between adjacent flutes.

Land Width: The distance between the leading edge and the heel of the land measured at a right angle to the leading edge.

Lips — Two Flute Drill: The cutting edges extending from the chisel edge to the periphery.

Lips — Three or Four Flute Drill (Core Drill): The cutting edges extending from the bottom of the chamfer to the periphery.

Lip Relief: The axial relief on the drill point.

Lip Relief Angle: The axial relief angle at the outer corner of the lip. It is measured by projection into a plane tangent to the periphery at the outer corner of the lip. (Lip relief angle is usually measured across the margin of the twist drill.)

Margin: The cylindrical portion of the land which is not cut away to provide clearance.

Neck: The section of reduced diameter between the body and the shank of a drill.

Overall Length: The length from the extreme end of the shank to the outer corners of the cutting lips. It does not include the conical shank end often used on straight

shank drills, nor does it include the conical cutting point used on both straight and taper shank drills. (For core drills with an external center on the cutting end it is the same as for two-flute drills. For core drills with an internal center on the cutting end, the overall length is to the extreme ends of the tool.)

Point: The cutting end of a drill made up of the ends of the lands, the web, and the lips. In form, it resembles a cone, but departs from a true cone to furnish clearance behind the cutting lips.

Point Angle: The angle included between the lips projected upon a plane parallel to the drill axis and parallel to the cutting lips.

Shank: The part of the drill by which it is held and driven.

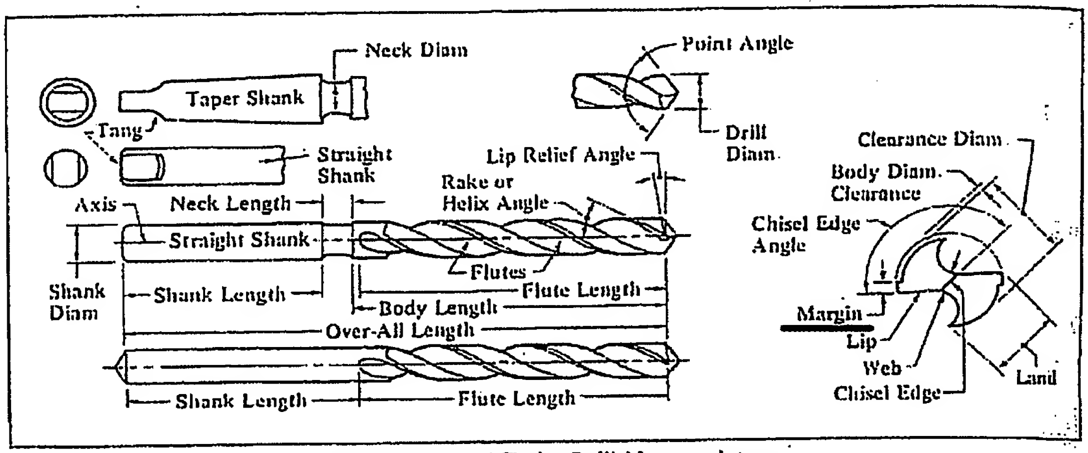
Tang: The flattened end of a taper shank, intended to fit into a driving slot in the socket.

Tang Drive: Two opposite parallel driving flats on the end of a straight shank.

Web: The central portion of the body that joins the end of the lands. The end of the web forms the chisel edge on a two-flute drill.

Web Thickness: The thickness of the web at the point unless another specific location is indicated.

Web Thinning: The operation of reducing the web thickness at the point to reduce drilling thrust.



ANSI Standard Twist Drill Nomenclature

Types of Drill. — Drills may be classified based on the type of shank, number of flutes or hand of cut.

Straight Shank Drills: Those having cylindrical shanks which may be the same or different diameter than the body of the drill. The shank may be with or without driving flats, tang, grooves, or threads.

Taper Shank Drills. Those having conical shanks suitable for direct fitting into tapered holes in machine spindles, driving sleeves, or sockets. Tapered shanks generally have a driving tang.

Two-Flute Drills: The conventional type of drill used for originating holes.

Three-Flute Drills (Core Drills): Drill commonly used for enlarging and finishing drilled, cast or punched holes. They will not produce original holes.

Four-Flute Drills (Core Drills): Used interchangeably with three-flute drills. They are of similar construction except for the number of flutes.

Right-Hand Cut: When viewed from the cutting point, the counterclockwise rotation of a drill in order to cut.

Left-Hand Cut: When viewed from the cutting point, the clockwise rotation of a drill in order to cut.